

**A Method of Producing a Vehicle Steering Wheel as well as a Vehicle  
Steering Wheel**

**Technical Field**

- 5        The invention relates to a method of producing a vehicle steering wheel as well as to a vehicle steering wheel produced by such a method.

**Background of the Invention**

- 10       Vehicle steering wheels normally comprise a one-piece steering wheel skeleton having a hub, at least one spoke and a steering wheel rim. The skeleton of metal is foam-encapsulated in the area of the steering wheel rim and the spokes. The foam-encapsulation procedure is complex and requires precise foaming molds. Moreover, the foam-encapsulated skeleton still has to undergo a finishing step.

- 15       German published examined application DE-AS 1,912,534 discloses a steering wheel skeleton that is not foam-encapsulated, but rather that is provided with a thick rubber covering in the area of the rim. However, the application and manufacture of this thick rubber covering, which has a profiled cross-section, are complex.

**Brief Summary of the Invention**

- 20       The object of the invention is to provide a method that allows the production of inexpensive steering wheels which, especially haptically, are still pleasant for the driver to grip. Moreover, a vehicle steering wheel offering these advantages is to be provided.

The first object is achieved by a method comprising the following steps:

- 25       a) a one-piece steering wheel skeleton having a hub, at least one spoke and a steering wheel rim is produced by means of casting or injection-molding,

b) an intermediate layer made of soft foam is glued directly onto the steering wheel rim and

c) the intermediate layer is covered with leather in that the leather is glued directly onto the intermediate layer.

5 As an alternative, the first object is achieved by a method comprising the following steps:

a) a one-piece steering wheel skeleton having a hub, at least one spoke and a steering wheel rim is produced by means of casting or injection-molding, and

10 b) a cover consisting of an inner intermediate layer made of soft foam and consisting of an outer covering made of leather is glued with its inside directly onto the steering wheel rim.

15 The above-mentioned second object, namely, the production of a vehicle steering wheel, is achieved with a vehicle steering wheel of the type described above in that the steering wheel rim is covered by a pre-manufactured intermediate layer made of soft foam and by leather, the intermediate layer being attached directly to the steering wheel rim and the leather being attached directly to the intermediate layer.

20 With the method according to the invention and the steering wheel according to the invention, foam-encapsulation of the steering wheel skeleton is no longer called for. On the contrary, the steering wheel rim is covered with the soft foam the outside of which, in turn, is adjacent to the leather. The soft foam gives the steering wheel rim the necessary soft but pleasant feel to the touch. Normally, the soft foam is stamped out of a flat, thin layer made of soft foam, that is to say, it is not pre-formed as a shell, which would make the production of the soft foam more  
25 expensive.

The steering wheel rim in the steering wheel according to the invention defines the outer geometry of the rim covered with leather and soft foam, something which is not provided for in the state of the art. On the contrary, in the

state of the art, the foam-encapsulation or the shells that are attached to the skeleton are the part or parts that define the outer geometry of the steering wheel rim once the steering wheel has been completed. However, since the steering wheel rim of the steering wheel according to the invention, that is to say, the ring of the skeleton that forms the steering wheel rim, defines the outer geometry, said ring is much thicker than in the state of the art, since all that is necessary is to glue the thin intermediate layer made of soft foam and the leather onto it.

In order to reduce the weight of the steering wheel rim and thus the tendency of the steering wheel rim to vibrate and also in order to be able to change the vibration tendency by varying the weight, said steering wheel rim has to be provided with recesses according to the preferred embodiment, e.g. on the underside or else on the underside as well as on the opposite top. The intermediate layer bridges the recesses in such a manner and the recesses are so narrow that they cannot be felt by hand.

The steering wheel skeleton independently of whether manufactured by the process defined in claim 1 or 2 is preferably made by means of aluminum or magnesium pressure die-casting, which allows the requisite filigree shapes.

#### Brief Description of the Drawings

Figure 1 shows a cross-section through the right-hand half of a vehicle steering wheel according to the invention, which was made by means of the method according to the invention,

Figure 2 shows a cross-section through a steering wheel rim in accordance with a second embodiment of the steering wheel according to the invention,

Figure 3 shows a cross-section through the steering wheel rim in accordance with a third embodiment of the steering wheel according to the invention,

Figure 4 shows a cross-section through a steering wheel rim blank for a steering wheel according to the third embodiment,

Figure 5 shows a cross-section through the steering wheel rim in accordance with a fourth embodiment of the steering wheel according to the invention,

Figure 6 shows a cut-away bottom view of a steering wheel blank in accordance with a fifth embodiment of the steering wheel according to the invention, and

Figure 7 shows a cut-away bottom view of a steering wheel blank in accordance with a sixth embodiment of the steering wheel according to the invention.

#### Detailed Description of the Preferred Embodiments

Figure 1 shows a vehicle steering wheel that has a skeleton made in one piece by means of pressure aluminum or magnesium die-casting or injection molding and that consists essentially of three sections, namely a hub 10, several spokes 12 of which only one is shown, and a steering wheel rim 14 that is continuous in the circumferential direction. A bore 16 in the hub allows the mounting of the steering wheel onto a steering shaft (not shown). Since the geometry of the steering wheel in the area of the other spokes (not shown) is designed in the same way as the spoke 12 shown in Figure 1 and since the spokes are uniformly distributed over the circumference, the half cross-section shown in Figure 1 is sufficient to define the geometry of the steering wheel in the part of the steering wheel that is essential for the invention.

No shell-shaped injection-molded part or foam-encapsulated part is placed onto the steering wheel rim 14 of the skeleton, nor is the steering wheel rim 14 directly encapsulated by means of injection-molding or foaming. On the contrary, the steering wheel rim is covered with a pre-manufactured intermediate layer 18 made of soft foam and then, on the outside, leather 20 is attached onto the soft foam.

The intermediate layer consists of a soft foam sheet that is flat before it has been attached and that has a stamped contour. The thickness of this flexible sheet

is constant. After the aluminum or magnesium pressure die-cast skeleton has been cast and deburred and, if necessary, mechanically reworked, the pre-manufactured intermediate layer 18 is glued directly onto the steering wheel rim 14.

5 Finally, in a subsequent working step, the stamped leather 20 is glued onto the outside of the intermediate layer 18.

As an alternative, it is also possible to attach the leather 20 and the intermediate layer 18 directly to each other before they are attached onto the steering wheel, resulting in a two-layered, flexible sheet the upper side of which is made of leather and the underside of which is made of soft foam. This unit is then  
10 glued directly onto the steering wheel rim 14.

Since the intermediate layer 18, like the leather 20, is very thin and flexible and has a constant thickness, the steering wheel skeleton, or to put it more precisely, the rim area of the steering wheel skeleton, also defines the outer geometry of the completely covered steering wheel rim that can be seen in Figure  
15 1.

In the area of the underside of the steering wheel rim, the skeleton has numerous, approximately 1 mm to 2 mm-wide, slit-shaped recesses 22 the main direction of extension of which lies transverse to the circumference, that is to say, in a radial section plane. Due to the recesses 22, the weight of the steering wheel  
20 rim 14 is considerably reduced. The recesses 22 cannot be felt from the outside because, between the recesses, radial webs remain, over which the intermediate layer 18 is applied.

In the embodiment shown in Figure 2, in which only the steering wheel rim is shown at a place remote from the spoke, the steering wheel rim 14' is provided  
25 with a round outer geometry. On the underside, the steering wheel rim 14' has recesses 22', whilst the upper side likewise can have recesses 24 provided alternately with respect to the underside recesses 22'. With this embodiment as well, the steering wheel rim 14' is surrounded by the intermediate layer 18 having a constant thickness, the intermediate layer 18 made of soft foam being glued

directly onto the skeleton. On the outside, the leather 20 is glued onto the intermediate layer 18.

As a result of the alternating upper side and underside recesses 22', 24, production by means of pressure die-casting is easier.

5        Figure 3 shows a cross-section of a third embodiment through the steering wheel rim. Unlike the first two embodiments, the recesses 22 here are at least partially covered by small projections 30 on which the intermediate layer 18 rests. In this manner, wider recesses can be provided which nevertheless cannot be felt from the outside. The possibility of using wider recesses leads to a greater design  
10        freedom in terms of the variation of the weight and the tendency to vibrate.

      The projections 30 can be easily obtained without an additional working step in that, during the injection-molding or casting, projections 30 are formed on the steering wheel rim 14 adjacent to the recesses 22 and then are deformed. Figure 4  
15        shows a steering wheel blank with formed-on projections 30' that extend approximately radially from the steering wheel rim. After the forming procedure, the steering wheel blank is placed into a deburring press that is indicated here by two punches 32. The punches 32 bend the projections 30' by about 90° so that they are located in the position shown in Figure 3, in which they cover the recess.

      Figure 5 shows a cross-section of a fourth embodiment through the steering  
20        wheel rim. Similar to the third embodiment, the recesses 22 here are at least partially covered so that they cannot be felt from the outside. Unlike the third embodiment, however, separate inserts 40 or covers are used, which are placed into the recesses 22 and are jammed, for example, in the tapered recess. If necessary, the inserts 40 can completely close off the recesses 22.

25        Figure 6 shows a bottom view of a steering wheel rim blank for a steering wheel according to a fifth embodiment. Unlike the first embodiment, in which the webs extend radially between the recesses 22, so-called cross-webs 50 are provided, that is to say, webs that intersect with at least one other web, for example, at the transition to the steering wheel rim.

Figure 7 shows a bottom view of a steering wheel rim blank for a steering wheel according to a sixth embodiment. Here too, cross-webs **50** are used, but in this case they run in the circumferential direction and intersect radial webs **60** at regular intervals.

- 5        In the fifth as well as in the sixth embodiment, on the one hand, a suitable arrangement and dimensioning of the cross-webs **50** or else of the cross-webs **50** and the radial cross-webs **60** can influence the weight and the vibration tendency of the steering wheel rim **14** in the desired manner and, on the other hand, the size of the hollow spaces formed can be set in such a way that they cannot be felt from
- 10      the outside. If desired, the projections known from the third embodiment or the inserts known from the fourth embodiment can also be used to cover the recesses formed between the webs. The webs can then serve as supports for the projections or inserts.